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Brief communication (Original)

National survey of helminthiasis in Thailand

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Background: Helminth infections continue to pose serious health problems in Thailand. The infections of greatest concern are opisthorchiasis and hookworm.

Objectives: We evaluated the prevalence of these infections. The Thai Ministry of Health established a national health plan in 1995 to coordinate health plans for the provincial public health sectors.

Methods: A national survey based on probability sampling, interviews, and stool examinations was conducted in 2009 to gather prevalence information of the helminth infections.

Results: We found an overall prevalence of helminthiasis among 15,555 Thai people of 18.1%. The highest prevalence was found in the northeastern regions of Thailand. By comparison with previous surveys conducted over the past 5 decades, the prevalence rates have decreased. However, pockets of high infection remain, particularly in the north and northeast of Thailand.

Conclusions: Targeted intervention by means of educational programs and public health intervention, and continuing surveillance are indicated.

Keywords: Helminthiasis, national survey, Thailand

Opisthorchis viverrini (OV) and hookworm infections (HW) continue to be significant public health problems in Thailand [1-5]. In Thailand, infections with *Opisthorchis viverrini* are associated with a high mortality secondary to cholangiocarcinoma (CCA) [6-9]. National surveys have defined the magnitude, location and effectiveness of the national helminthiasis control program. Geographical information systems (GIS) can be applied to analyze helminth ecology including the mapping of available epidemiological information and related factors [10]. These can be correlated with health risk behavior data to assess effectiveness of the Control Program for OV, HW, and *Strongyloides stercoralis* infections. This study investigated the prevalence of helminthiasis among subjects older than 6 months in 75 provinces of Thailand in order to determine the intensity of opisthorchiasis and hookworm infections in positive groups. The national survey data of the health status and risk behaviors can then be used in targeted treatment and education for parasite control in the identified high risk groups.

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Methods

This national cross-sectional survey was conducted in 75 provinces during the period of January through May 2009. Investigators visited randomly selected areas of the districts, accompanied by local Public Health officials. After documented informed consent from participants, parents of minor participants or their legally authorized representative, and assent were obtained, 15,555 participants from all age groups were interviewed (or their parents or legally authorized representative) and stool samples were collected. Stool specimens were fixed with formalin and stored before examination in the laboratory of the national survey program. The formalin–ether concentration technique was used to process all specimens. Modified Kato–Katz technique was performed to quantify the intensity of parasites from 20% of the positive samples of *Opisthorchis viverrini* and hookworm infections [11-13]. The

presence of helminth parasite eggs and larva was determined microscopically. The positive cases were treated with either albendazole or praziquantel [14-16]. Data were analyzed using descriptive statistics of percentages, mathematical means and standard deviation to determine the prevalence rates and intensity.

The Human Ethics Committee of the Ministry of Public Health approved this project on 26 January 2009 under ICH-GCP [8/51-263] following the principles of the Declaration of Helsinki.

Results

The 15,555 recruited subjects had a male to female ratio of 1:1.41 (**Tables 1**). Microscopy revealed parasites in 2,816 stool samples (18.1%). The majority of detected parasites were *Opisthorchis viverrini* (1,351 cases, 8.7%). Other intestinal parasites included hookworm, *Ascaris lumbricoides, Trichuris trichiura, Taenia* species, *Enterobius vermicularis, Strongyloides stercoralis*, intestinal fluke, *Echinostoma* species, *Fasciolopsis buski, Trichostrongylus orientalis, Hymenolepis diminuta, Capillaria philippinensis,* and *Hymenolepis nana* (**Tables 2**).

Discussion

The results showed a persistent high prevalence of liver flukes and hookworm infections in certain regions of Thailand. The crude overall prevalence of infection in the study population was lower than the overall prevalence rate of 15.7% for northeastern Thailand observed in 2001 [2]. The variability between different geographic regions is shown along with seasonal variations that might serve as an explanation for this discrepancy [17]. However, by comparison with rates in 1981, when 34.6% of all observed people in the northeast were infected with *O. viverrini*, some success of the implemented liver fluke control program is evident [18].

Nevertheless, data derived from our study demonstrated that there are still groups predisposed to high infection rates. Male participants had higher rates of infection than female participants, possibly because of higher rates of exposure through work activities and consumption of raw fish. Low levels of education are associated with higher prevalence rates.

Younger age groups had a lower prevalence of infections for both hookworm and *O. viverrini*. This may be the consequence of less time for exposure to infective sources for hook worm, a shorter duration of consumption of raw fish and less time for the infections to become evident. Limited education in the populations at risk could also contribute to a lack of understanding and use of health care information. Active control programs for *O. viverrini* and hookworm by the Ministry of Public Health have been implemented continuously. However, these diseases are still widely distributed, with the highest occurrence in the north and northeastern regions.

Differences in the prevalence of infection presumably reflect variations in environmental conditions and social behavior.

Table 1. Demographic information of the population

Variable	Number	%
Sex		
Male	6426	41.4
Female	9089	58.6
Age (years)		
6 month–4	187	1.2
5–9	266	1.8
10–14	261	1.7
15–19	348	2.3
20–29	729	4.8
30–39	2521	16.6
40–49	4081	26.9
50–59	3709	24.5
60 up	3044	20.1

Mean = 46.61 y, SD = 15.88 y, median = 48 y, mode = 52 y, maximum = 99 y, minimum = 11 months

Table 2. Prevalence of helminthiasis grouped by the four regions of Thailand

Region	Number	Positive n (%)	Hw n (%)	Ov n (%)	Al n (%)	Tt n (%)	Tspp n (%)	Ev n (%)	Ss n (%)	IntF n (%)	Espp n (%)	FB n (%)	TO n (%)	HD n (%)	CP n (%)	HN n (%)
Middle	3235	185 (5.8)	103 (3.2)	43 1.3	1 (0.1)	14 (0.5)	7 (0.3)	1 (0.1)	18 (0.6)	11 (0.3)	4 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
North	4394	776 (17.7)	171 (3.8)	440 (10.0)	21 (0.5)	19 (0.4)	36 (0.8)	3 (0.1)	92 (2.1)	128 (2.9)	3 (0.1)	0 (0.0)	4 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)
Northeastern	4648	1207 (26.0)	221 (4.7)	865 (16.6)	0 (0.0)	19 (0.4)	70 (1.6)	2 (0.1)	128 (2.8)	106 (2.3)	68 (1.5)	0 (0.0)	2 (0.1)	3 (0.1)	0 (0.0)	0 (0.0)
Southern	3278	648 (19.8)	517 (15.8)	3 (0.1)	55 (1.7)	130 (3.9)	0 (0.0)	5 (0.2)	17 (0.5)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	15555	2816 (18.1)	1012 (6.5)	1351 (8.7)	77 (0.5)	182 (1.2)	113 (0.7)	11 (0.1)	155 (1.7)	246 (1.6)	75 (0.5)	0 (0.0)	6 (0.1)	3 (0.1)	1 (0.1)	1 (0.1)

Hw = hookworm, Ov = *Opisthorchis viverrini*, AL = *Ascaris lumbricoides*, Tt = *Trichuris trichiura*, Tspp = *Taenia* species, Ev = *Enterobius vermicularis*, Ss = *Strongyloides stercoralis*, Int. F = intestinal fluke, Espp = *Echinostoma* spp., FB = *Fasciolopsis buski*, TO = *Trichostrongylus orientalis*, HD = *Hymenolepis diminuta*, CP = *Capillaria philippinensis*, HN = *Hymenolepis nana*. Maximum 25,000 epg (eggs per gram), Minimum 23 epg.

The global socioeconomic burden of parasitic zoonoses is unknown. Further studies should address zoonotic diseases and their intermediate and reservoir animal hosts. The cost of intervention in animals may well reduce the costs for human control [19].

Conclusion

In Thailand, considerable progress has been made in the reduction of the rates of helminthiasis during the past 50 years. However, *Opisthorchis viverrini*, hookworm and *strongyloides stercoralis* remain important helminthic infections. They require continuing surveillance and control, particularly in identified high risk areas and among high risk groups. The north and northeastern regions are still high risk areas; particularly among the rural population. These results demonstrate that geographic spatial analysis can help to identify patterns of high risk for infections with *Opisthorchis viverrini*, hookworm and *Strongyloides stercoralis*. This present study indicates that there is still a need for further aggressive control programs regarding *O. viverrini* infections in rural areas, particularly in the north and northeastern regions. *Opisthorchis viverrini*, was found in more than 9% of all subjects.

In the northeastern regions of Thailand, centuries old traditions of food preparation include the consumption of raw fish. This diet may also be related to poverty and the ease of consumption of local fish products. Increased education about the risks of eating raw fish is essential for the control of liver fluke infections. Likewise public health education of those at high risk can reduce the occurrence of *O. viverrini* and hookworm infections [14-16]. Active community participation is fundamental in implementing the control programs. This national study provides fundamental information for the helminth infections in Thailand. This survey also provides a basis for future study and monitoring of these infections.

Further sociological studies are recommended to assess continued risk behaviors in the transmission of opisthorchiasis and other intestinal parasites. Regular reassessment of the prevalence of helminthiasis in the Thai population by means of National Surveys of Helminthiasis will be useful in assessing the progress and merits of the variety of intervention programs.

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